to undergo repair during the intervals of darkness. The æsthetic superiority of the analytic colours over black, white, and grey is explained by considerations analogous to those which have just been mentioned in the case of musical tones and noises; while harmony of colours is treated in the same way as harmony of sounds. A somewhat curious speculation is ventured to explain the apparent deficiency of the red-perceiving elements. "It is clearly desirable that the eyes of the frugivorous animals should be *pleasurably* stimulated by reds, oranges, and purples; and the simplest contrivance for effecting this end would be to give the greatest possible rest to such elements as answer to stimulations of these orders. Accordingly, they ought only to be excited by comparatively powerful stimulations of their proper kinds."

Adopting Mr. Spencer's view[1] as to the ideal being a faint central stimulation of such nerve-fibres as would receive strong peripheral stimulation by the reality, Mr. Allan carries his analysis to the limit where "Physiological Æsthetics" must end, and where Psychological Æsthetics ought only to begin. Space, however, will not allow us to follow him into this division of his subject. Enough has been said to show that his work deserves the attention of psychologists; and it may be added that as he throughout clearly explains both the physics and the physiology of his subject, his entertaining little treatise will prove instructive to any general readers who may be desirous of observing the intimacy of those relations between psychology and the lower sciences, which the magnificent generalisations of recent years are now every day bringing into clearer prominence.

GEORGE J. ROMANES

OUR BOOK SHELF

Select Plants readily Eligible for Industrial Culture or Naturalisation in Victoria, with Indications of their Native Countries and some of their Uses. By Baron F. von Mueller, C.M.G., F.R.S., &c. (Melbourne: McCarron, Bird, and Co.)

THIS is another form of Baron Mueller's numerous and widely-spread contributions to the Acclimatisation Society of Victoria—numerous we say, because the Baron's pen is always at work upon botanical matters, the consideration of useful plants being apparently one of his favourite themes, and widely spread, because these papers on "select plants" seem to have been freely distributed not only in Australia and in this country, but also in America, where indeed some portion, if not all, have been republished. The present issue, Baron Mueller tells us, is a rearranged and largely supplemented form, which has been taken up by the Government of Victoria, and published under their authority. The book, which numbers some 293 pages octavo, contains references to an immense number of plants, the information attached to each being brief but withal accurate. The generic and specific names are arranged alphabetically from beginning to end, and this arrangement is perhaps the best for general use. After the scientific name, the vernacular name is given, then the geographical distribution or habitat, followed by a note as to the nature of the plant, whether a tree, shrub, or what not, and finally a brief description of its properties and uses. As a proof that Baron Mueller has corrected this latest issue of his papers, down quite to the present time we may mention that under *Nicotiana tabacum*, Lattakia tobacco is included, and it is only within a comparatively recent date that Mr. Thiselton Dyer has shown this to be right, nearly all previous writers having attributed it to *N. rustica*. At the conclusion of the book a very good plan is adopted of classifying the plants mentioned under distinct heads referring to their uses; thus, under alimentary plants, the generic names of all such are placed; the same under dye plants, fibrous plants, and so on. A good index is given of vernacular names only, which is quite sufficient when it is remembered that the scientific names are arranged alphabetically throughout the book.

[1] Here, as indeed in most other places, Mr. Allan does not express his obligations. Doubtless, having a psychological public in view, he thought it superfluous to state the sources from which such well-known conceptions have sprung; but as his work is in all other respects adapted to badly-informed readers, it would have been desirable, on their account, to have supplied these omissions.

Notes on the Ancient Glaciers of New Zealand. With Map. By J. C. Russell. Reprinted from the "Annals of the Lyceum of Natural History." (New York: November, 1876.)

MR. RUSSELL was attached to the U.S. Transit of Venus Expedition, and finding himself stationed on the shores of Lake Wakatipu among the snow-fields and glaciers of the South Island of New Zealand he read what had been written on the ice-work of that region and supplemented his reading by the personal observations recorded in these notes. Though he does not add any important new fact to our previous knowledge he gives an interesting *résumé* of the physical geography of the glacier region, pointing out the evidence for the former greater extension of the ice-fields of New Zealand, and dwelling especially on the proofs of enormous erosion shown by the valleys and lake-basins.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

Nectar-secreting Glands

I HAVE briefly described in vol. xv. of the Linnæan Society's *Journal*, the nectar-glands found at the base of the fronds of the brake fern (*Pteris aquilina*) which are visited by ants for the sake of their sweet secretion. This case seemed to me to show in a striking manner that extra-floral nectar-glands are not necessarily protective in function, because the fern has, in England at least, extremely few enemies. The following extract of a letter lately received from Fritz Müller (of St. Catharina, Brazil) is of considerable interest in relation to this subject. He states that "the honey-glands on our *Pteris aquilina* serve, without doubt, to protect the ferns from the depredations of the leaf-cutting ants (Œcodoma), as is the case with Passiflora, Luffa, and many other plants. The glands of the Pteris are eagerly visited by a small black ant, Crematogaster, of which the Œcodoma seems to stand in great dread. On the other hand, when no protecting ants are present, I have seen Œcodoma gnawing the young fronds; here, as in other cases, it is only the young leaves that stand in need of protection, the older ones not being attacked by the leaf-cutting ants." This fact might, no doubt, be used as an argument by those who believe that all nectar-glands were originally developed as protective organs, and this argument would have great force if it could be shown that *Pteris aquilina* is a form which has arisen in countries where protection is needed; but even in that case there would remain the difficulty of accounting for the continued functional activity of the glands in districts where no such protection is required. Or it may be said that in past ages the glands on our European Pteris served as a protection against enemies which have now become extinct. But here we are again met by the difficulty of accounting for the continued activity of the glands. It is characteristic of evolution that great changes occur in the functions of organs, and I think that it will generally be allowed that even the most beauti-

fully adapted apparatus must have originated in an organ performing some comparatively simple function. The question at issue may perhaps be stated as follows :—In the cases where the nectar-glands are now well developed has there been a special course of structural development in close relation with the need of the plant for protection? Has there been a course of evolution such as we may believe has taken place in the formation of the food-bodies in *Acacia sphærocephala* and *Cecropia peltata*, or should we not rather believe that the sweet secretion has been developed in connection with some unknown process of nutrition; according to this view, a well developed system of glands may continue merely performing some obscure excretory function, and consequently, although the presence of nectar-glands has undoubtedly been of the utmost importance in determining the survival of certain species, yet it is hardly fair to assume that all nectar glands were originally protective in function. For many plants secrete large quantities of sweet fluid, which serves no such purpose. This argument is given by my father in his "Effects of Cross and Self-Fertilisation" (p. 402). In addition to the facts there given in support of this view, a curious case described by Prof. H. Hoffmann may be mentioned ("Ueber Honigthau," 1876). He states that numerous large drops of sweetish fluid appeared on the under-surface of the young leaves of a camellia. He also alludes to a similar abnormal production of honey-dew on an ivy plant.

In the case of introduced plants, we see how an already existing quality may, without any special course of development, become of vital importance to its possessor. Thus, Mr. Belt shows ("Naturalist in Nicaragua," p. 74) that the lime, *Citrus limonum*, is able to exist in a wild state, because its leaves are, from some unknown reason, distasteful to the leaf-cutting ants; whereas the orange, *C. aurantium*, and the citron, *C. medica*, can only survive with the help of man.

Fritz Müller concludes his letter with some curious facts on kindred subjects:—

"The extreme variability of the nectar-glands on the leaves of many plants, is a somewhat remarkable fact. Thus our Citharexylon has normally two large glands at the base of the leaves, but sometimes there is only one, and sometimes none at all; besides these there are small glands scattered over the surface of the leaf, the number of which varies from twenty to none. Similar variations occur in the nectar-glands of *Alchornea erythrospermum*, and of a Xanthoxylon. It seems to me probable that in all the cases at present known, these glands serve to attract protecting ants; and I here agree with Delpino, although I do not hold with him that caterpillars are the chief enemies which are guarded against by Pheidole and Crematogaster; but I think with Belt that these latter ants protect the plant against the leaf-cutting species. Indeed it is precisely those plants which are free from the attacks of ants that seem to be especially well fitted for caterpillars. Thus the larvæ of Gynacria live on *Cecropia peltata*, those of *Epicalia numilia* on *Alchornea erythrospermum*. On the Cayien (?) whose leaves are furnished with nectar-glands, and are visited by protecting ants, the caterpillars of many species of Callidryas are found. Finally, as far as I know, all the larvæ of the genus Heliconius feed on Passiflora. Moreover, the same relation holds in the case of plants protected in other ways, for instance, by stinging hairs or by poisonous sap. How numerous are the larvæ found on the European stinging-nettle. In this country we find the caterpillars of 'Ageronien' on the stinging Dalechampia; and again those of some species of Danais on Asclepias, which is protected by its milky juice." FRANCIS DARWIN

Down, Beckenham, May 21

Quartzite Implements at Brandon

AT the recent conference held by the Anthropological Society on the present state of the question of the antiquity of man, the president, Mr. John Evans, referred to the finding of implements made of quartzite at Brandon, and remarked that as that rock did not exist in the neighbourhood excepting in the glacial drift, the implements must have been made from pebbles obtained from the glacial beds, and were therefore of post-glacial age. This statement was made at the end of the meeting when there was no opportunity of replying to it, and as its effect must have been great, I shall be obliged if you will allow one who believes that none of the palæolithic implements are of post-glacial manufacture to make some remarks upon it.

For a full description of the implement-bearing deposits near Brandon I must refer to an able paper by Mr. J. W. Flower in the twenty-fifth volume of the *Quarterly Journal of the Geological Society*. Gravel Hill, near Brandon, is an isolated hill rising to a height of 91 feet above the river, from which it is nearly a mile distant. It is covered with gravel which is mostly, and in some places entirely, composed of quartzite pebbles. Mr. Flower estimates that three-fourths of the whole are of quartzite. In this the gravel differs from that of other pits in the neighbourhood of Brandon, as for instance, that at Bromhill, which contains only one thirtieth part of quartzose pebbles.

At Gravel Hill, along with some hundreds of flint implements, four made of quartzite, similar to that of the pebbles, have been found. All the implements are usually found at the bottom of the gravel, and occasionally lie on the chalk. On the supposition that the quartzose pebbles, from which some of the implements have been made, were brought by ice in the glacial period, some such succession of events as the following must have occurred. 1. Ice, from the north, carried thousands of quartzite stones and deposited them in immense abundance over a limited area. 2. Man afterwards made implements from some of them. 3. The whole of the pebbles were rearranged and formed into beds of gravel with the implements at the bottom, whilst the distinctive character of the deposit was retained.

This ingenious but complicated theory is not necessary, for quartzose boulders and pebbles are found in deposits much older than the glacial period not very far away from the locality, and may exist beneath the drift close to it. It has long been known to geologists that there are many fragments of old crystalline rock in the upper greensand. They have been described by Mr. Bonney in his geology of Cambridge, and very fully by Messrs. Sollas and JukesBrowne, who state that fragments of gneiss, mica, and hornblende schists, talcose schists, granites, vein quartz, grits, quartzites, and slates are very numerous in this bed. It ranges northward from Cambridge, and is lost beneath the surface gravels and boulder clays, but it is not at all improbable that it may run along to the west of Brandon, and there contain even more quartzose fragments than in Cambridgeshire.

I may remark in conclusion that Mr. Flower, in his description, states, that he is disposed with the French geologists, to ascribe the outspread of the gravels to some powerful cataclysmal action, and that he does not know of any boulder clays in the course of the river from which such a mass of pebbles could have been derived. THOMAS BELT

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The Migration of the Swiss Miocene Flora

WITH reference to the route the plants took which formed the European miocene flora, I should be glad to know *why* Dr. Unger considers it to have been from America to Europe. He says: "There is more than *one* reason for thinking that the centre from which our lignite flora has sprung was far away from Europe—in the southern parts of the United States" (*Journ. of Bot.*, iii. 17). He thinks that the living flora of that part of America is the lineal descendant of that which gave rise, by aid of "Atlantis," to the Swiss miocene flora. But is enough known of the miocene flora of the United States to infer this? Prof. Heer says that the methods of comparison he employed "incontestably prove that Switzerland was inhabited by types now scattered over every part of the world [agreeing in that respect with the existing Arctic flora], but of which the majority correspond with species of South U.S. of America; the Mediterranean region of Europe ranks second; Asia Minor, the Caucasus, and Japan third; the Atlantic Isles fourth, and North Holland fifth" (*Nat. Hist. Rev.*, 1862, p. 154, quoted by Oliver). Prof. Oliver and Sir Charles Lyell think that the route was by Japan, and not by the Atlantis; but still (Sir Charles, at least) *from* America *to* Europe. Heer, in his "Primæval World of Switzerland" (vol. i. p. 325, Eng. ed.), says the *Glyptostrobus heterophyllus* of Japan "has probably been derived from the tertiary species" [of Europe]. Similarly, in comparing the *Taxodium distichum miocenum* with that of America, he observes: "It is very interesting to find that the ancestors of the existing American swamp-cypresses were formerly spread over the whole of Europe, as far as 78° N. lat. Again, of *Sequoia Langsdorfii*, he observes: "It probably formed a zone round the whole earth in high northern latitudes."

Instead, then, of regarding either Switzerland or the South U.S. as a "centre," I would suggest that the miocene flora was uniformly spread over the whole of the regions bordering the